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Comparison of Open Craniotomy vs Conservative Treatment in Minor Spontaneous Intracerebral Hemorrhage (ICH) : A Comprehensive Systematic Review

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ABSTRACT

Introduction: Intracerebral hemorrhage (ICH) accounts for 10–15% of all strokes in the USA, Europe and Australia, and 20–30% of Asian cases, with a 30-day mortality rate of 35% to 52%; half of the related deaths occur in the first 2 days. Its overall incidence is 24.6 per 100,000 person-years, indicating that it represents the most fatal type of stroke around the world.

Methods: The aim of study of this study to investigate the comparison of open craniotomy vs conservative treatment in minor spontaneous intracerebral hemorrhage (ICH). This study used the systematic review method by discovering articles using the search engine PubMed, SagePub, Science Direct and 5 articles met the inclusion criteria in this study.

Results: : Five publications were found to be directly related to our ongoing systematic examination after a rigorous three-level screening approach. Subsequently, a comprehensive analysis of the complete text was conducted, and additional scrutiny was given to these articles.

Conclusion: Surgical management on intracerebral hemorrhage has unique advantages as it can remove the hematoma effectively and decrease intracranial pressure and the incidence of complications.

Keyword: Intracerebral hemorrhage (ICH); surgical; treatment; craniotomy; conservative.

1. Introduction

The broad definition of traumatic brain injury (TBI), one of the main causes of death and disability in the world, is brain damage brought on by a severe event. The most common causes of TBI include car accidents, sports-related injuries in children, and unintentional falls in the elderly. It is possible to tell the difference between primary injury, which is caused by external forces striking the skull directly, and secondary injury, which happens as the lesion worsens as a result of cellular damage such ischemia and edema.[1]

According to research, the pattern of functional impairments and the course of recovery depend on the severity of the initial damage and, in the case of mild traumatic brain injury (mTBI), the number of impacts received. Multiple cognitive processes, including learning and memory, attention, and processing speed, are impacted by a single mTBI. In two to four weeks, the majority of people return to their pre-injury levels of functioning, while a tiny minority (15%) may have long-lasting cognitive problems. mTBIs (rmTBIs) that regularly occur in a short period of time appear to prolong this healing period.[2]

Clinical severity of TBI is generally determined by the Glasgow Coma Scale. The severity of a brain injury can be quickly assessed using the Glasgow Coma Scale (3–15). The sum of the test's three component scores—eye, verbal, and motor—is used. 8 being very severe, 9–12 being moderate, and 13–15 being minor.[3] The CDC recorded 2.53 million Emergency Department (ED) visits associated with TBI in 2014. Fifty-six thousand eight hundred died from TBI-related causes, and there were about 288,000 hospitalizations connected to TBI.[3] Both adults and kids are represented in this data. It is predicted that 69 million (95% CI 64-74 million) persons worldwide experience TBI annually, with Southeast Asia and the West Pacific facing the highest illness burden.[4]

Mild traumatic brain injury (mTBI) concussions are connected to short-term motor skill impairment and impaired cognitive performance. With nearly three million incidents of mild traumatic brain injury (mTBI) occurring annually in the United States, the majority of concussion research has concentrated on post-impact behavioral, cognitive functioning with an emphasis on immediate effects (e.g., athletes in their teens or early 20s) or more long-term implications (e.g., older adults at risk for dementia and Alzheimer's disease earlier in life). Less research has been done on the likelihood of long-term cognitive issues in young adult non-athletes who experienced a concussion as an adolescent.[5,6] We aimed to discuss the overview of concussion-related to long-term cognitive impairment among traumatic brain injury.

2. Methods

The results of the current systematic review were presented in accordance with a structured review methodology and the recommended reporting guidelines for systematic reviews and meta-analyses (PRISMA). The following search criteria were used by the author (M.R.H) to search the databases of PubMed, ScienceDirect, and the British Medical Journal: ("Traumatic Brain Injury" OR "concussion") AND ("cognitive impairment" OR "cognitive dysfunction"). The author looked over all of the articles up until March 2023. Before comparing chosen papers reporting on the outcomes of patients with cognitive impairment owing to traumatic brain injury published in the English language, the author independently rejected non-relevant studies based on a review of the full-text articles. The flow of studies included is presented in Figure 1.

3. Results

From the first literature search, 969 publications were included: 150 papers from PubMed, 504 from ScienceDirect, and 325 from the British Medical Journal. In this preliminary screening, we removed studies that lacked information comparing good and bad responders. Finally, after reading the titles and abstracts of 27 publications, we determined their relevance, and after reading the full texts, six studies were chosen to be included in our systematic review.

Each individual's baseline and post-injury performance was analyzed using a different standard score. Performance for symptomatic individuals post-injury means damaging reductions in retrieval fluency, sentence reading fluency, pattern matching, and all cluster scores. Other areas where individual performance deteriorated included retelling stories, verbal working memory, and visual processing.[7]

According to Muhammad Az et al., the significant WM (White Matter) tracts, such as the corpus callosum, external and internal capsules, cingulum, inferior and superior longitudinal fasciculi, had noticeably higher diffusivity and were associated with the cognitive deficits in the trauma groups.[8]

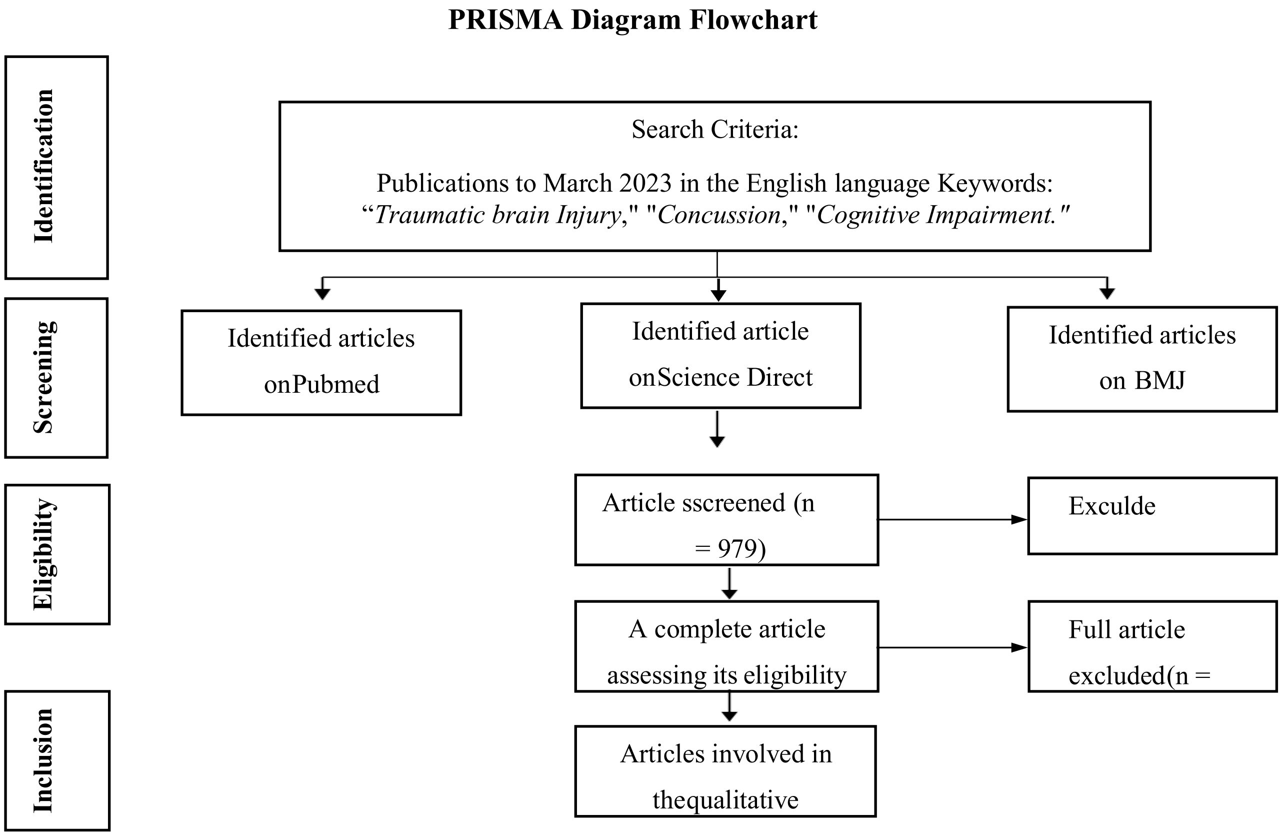

Figure 1. The PRISMA flowchart in identifying the literature included

Gorgoraptise et al. found 240 persons who were evaluated: 174 (72.5%) males, median age (range): 44 (22-91), n=172 (71.7%) moderate-severe, 41 (23.8%) mild, 27 (11.3%) symptomatic TBI. Compared to age-matched UK normative data, SF-36 scores from TBI patients were lower across the board. The HRQoL (Health Related Quality of Life) of patients with cognitive impairment was lower in terms of mental health, as well as physical, social, and emotional role functioning.[9] Several high-quality studies have suggested that concussion is a cause of cognitive impairment, which can be seen in Table 1.

4. Discussion

Over 42 million people worldwide suffer from mild traumatic brain injury (mTBI), which accounts for 85% of all traumatic brain injuries. Adults' symptoms typically last two weeks, although 10–20% experience ongoing post-concussion symptoms (PPCS). Even though the cognitive function is frequently quickly restored following mTBI, research indicates that 50% of persons with mTBI still have persistent cognitive impairment three months after the injury.[15] Between 12 and 24 months after an mTBI, impairments in executive function, working memory, and episodic, immediate, and delayed memory were also seen. While it has been claimed that the cognitive symptoms of mTBI can last for a long time, research on the long-term cognitive impact of mTBI is limited.[16] The authors believe that the effects of mild traumatic brain injury can affect the cognitive decline in a person due to molecular disturbances in the brain. However, some cognitive factors can be assessed. It takes time for the brain to recover after a head injury.

Traumatic injuries cause direct, rotational, and shear stresses that interfere with regular cellular activity in the brain. These forces could be present at all injury severity levels. Diffuse axonal damage can result from axon disruption caused by rotational stresses in the brain's white matter pathways. Damage to the white matter tract may be assessed using a specialized MRI method called diffusion tensor imaging. Axonal damage also causes localized edema, which delays signal transmission. Traumatic damage is also linked to alterations in cerebral blood flow. The first phase of these changes is a reduction in blood flow followed by an unresponsive vasodilation that is considered to be caused by the production of nitric oxide in the tissue. The rodent studies that best capture these vascular phenomena in mild traumatic brain injury (mTBI) studies.[6,10]

Table 1. Summary of Studies

Authors	Results
Schneider A.L.C et al.,2022	We created and established the concurrent validity of a clinically relevant definition of the poor 1-year cognitive outcome, incorporating both cognitive impairment and cognitive decline, for patients who presented acutely to level 1 trauma centers with mTBI (GCS score 13–15). According to our research, patients with mTBI experience poor cognitive outcomes frequently—13.5% (range 13.5%–44.8%, depending on the criteria used) compared to 4.5% (range 4.5%–36.7%, depending on the definition used) of controls.[10]
Wang, M.L et al.,2022	The most common cause of mTBI (15/23, 65.22%) is automobile accidents. Three patients had scores of 14, one had a score of 13, and 19 patients had scores of 15 on the Glasgow Coma Scale (GCS). Neuropsychological evaluations and MRIs were conducted on average 39 days following the injury. There were cerebral microbleeds in five mTBI patients, but no mTBI patients showed widespread axonal damage. The patients with mTBI did not significantly differ in age, sex, or education from the control subjects. However, in the areas of verbal memory, attention, and executive function, patients with mTBI performed poorly.[11]
Hardin. KY,2021	This study discovered a within-subject WJIV (Woodcock Johnson IV) performance loss in communication domains following a concussion sustained while participating in sports. It confirmed that cognitive-communication problems in mild traumatic brain injury should be taken into account. Speeded naming, reading, and verbal memory were important cognitive-communication skills; however, oral understanding was not change-sensitive. In order to expand on these preliminary findings, additional clinical research with a variety of demographics is required.[12]
Saba ES et al.,2021	The idea that persistent microglial dysfunction may contribute to the chronic progressive neurodegeneration seen years after head injury is supported by changes in microglia phenotype and function over time. The mild and severe TBI groups displayed statistically significant sensory-motor and cognitive abnormalities at 48 hours following CCI in comparison to the sham animals. Finally, we have examined the microglia response within the subcortical areas, as they are crucial in creating and processing spatial learning, memory, and relaying sensory and sensory and motor signals, in order to link microglial phenotypes to the cognitive deficiency.[13]
Gorgoraptis N et al.,2019	Our findings support the negative effects of TBI on HRQoL (health-related quality of life). Our TBI patient group's HRQoL was worse across the board compared to a normative group that was matched for age, gender, and location. This is consistent with other earlier investigations that included a range of TBI patient categories. The effects of cognitive impairment on these specific HRQoL areas further highlight the need for increased social assistance for people who are struggling with cognitive issues after a TBI.

	Poorer health-related quality of life after TBI is linked to cognitive impairment, which also partially mediates the impact of depression symptoms on emotional role functioning.[9]
Moore RD et al.,2018	According to the findings presented here, a sizeable amount of SRC is linked to enduring changes in functional connectivity, cerebral blood flow, and neuroelectric function. Clinicians may be able to distinguish between patients with normal and atypical recovery profiles using specific hemodynamic characteristics associated with altered connection and cerebral blood flow. Specific deficiencies in motor control, cognition, and psycho-affective health can be found using EEG/ERPS. Despite being varied, SRC regularly affects particular components of cognition and sensory perception, such as executive control, attention, and memory. Examples include sensory capture, convergence, sound sensitivity, and vestibular-ocular reflex. Importantly, sensory anomalies also seem to predict the strength and duration of cognitive, emotional, and physical symptoms.[14]

Both focal and diffuse injuries can occur within the same patient. The direct or indirect impact might result in focal harm. With relation to acceleration-deceleration force, indirect influence is regarded as secondary. As the cerebral spinal fluid (CSF) surrounds the brain, the force from direct contact will cause the brain to move to the opposite side of the skull, causing a second impact—the most common link between focal injuries and damage to the frontal and temporal lobes. Problems with executive function, impulsivity, and disinhibition are associated with damage to these regions.[11,12]

Previous research stated that a large multisite cohort study of individuals with mTBI (GCS 13–15) revealed that cognitive impairment is a prevalent symptom.[10] The primary cause of mTBI is a GCS 13–15 traffic collision. As a control, there are no appreciable variations in age, sex, or education. Regarding verbal memory, attention, and executive function, the patient with mTBI fared worse.[11] It has been shown in earlier investigations that microglia may be involved in ongoing neurodegeneration. Microglia response in the subcortical regions carries out the critical information and processing of spatial learning, memory, and relaying sensory and motor signals.[13] Poorer health-related quality of life is associated with cognitive impairment, which also modulates the impact of depressive symptoms on emotional role performance.[9]

The person who attains this level of functioning may also suffer from various illnesses, cognitive impairment, and physical restrictions that affect daily functioning and the perception of life's quality. For instance, incomplete functional recovery (i.e., a GOSE score below 8) was reported by 83% of msTBI and 53% of mTBI participants five years after the injury, reflecting stable odds of incomplete recovery from 1 to 5 years (i.e., no interaction with the year) that remained higher than the OTC group (38% at five years). For both categories, the percentage of people with lower TBI-related symptom burden and more excellent health-related quality of life remained steady over time. Similar symptoms and quality of life results were seen in the TBI groups. Nevertheless, neither TBI group had better symptom or quality of life results than the OTC group. These studies illustrate the necessity to look into the underlying causes of long-term impairments reflected by various clinical outcomes and show how damage variables have varying degrees of significance across clinical outcomes.[17]

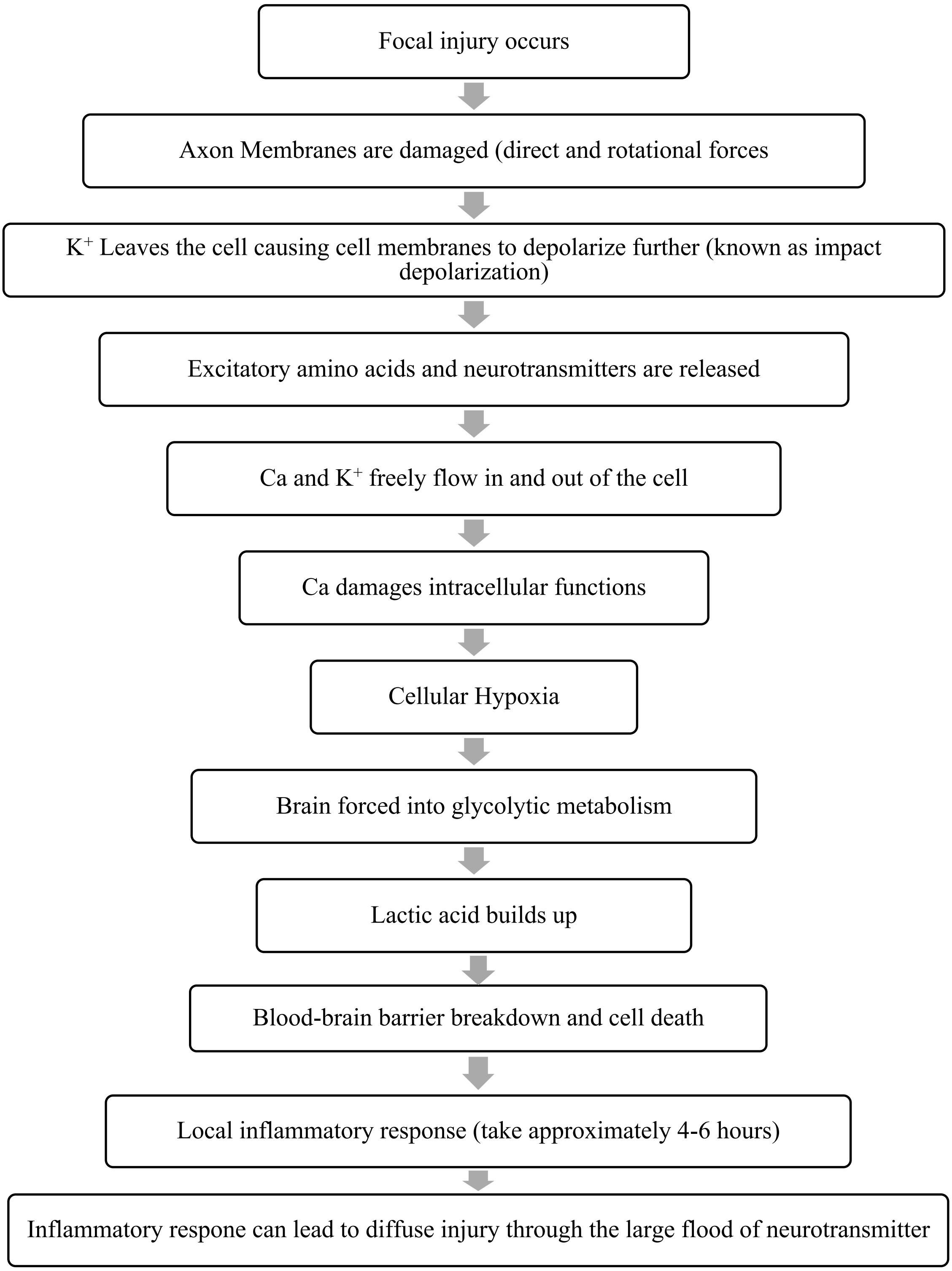

Figure 2. Neuromechanism of Focal Injury leads to concussion (Adapted from Capizzi A)

This study also identified several social factors that influence the results of long-term TBI. Irrespective of injury group and recovery period, those who were older, female, had lower baseline education levels, Medicaid or no insurance at the time of the accident, and had histories of past TBI had a higher likelihood of less favorable outcomes. Although the damage's cause was unrelated to the results, a previous study suggests that assaultive injury may predict some results. (Our sample did not have enough assault instances, so we could not study this group individually.) When considered collectively, our research confirms the general understanding that various variables affect TBI recovery. The development of more potent therapies will be aided by a nuanced examination of the biological mechanisms by which sex, age, and TBI recovery are impacted. Also, it is essential to consider the challenges many Individuals with TBI have in obtaining healthcare due to inadequate health insurance coverage.[17]

The sample measurements from parts of the literature varied. The comparison of cognitive levels reveals disparities in the control variables. Measurement methods used in cognitive tests differ from parts of the literature. Differences in the cognitive parameters evaluated were discovered by Wang et al. and Hardin K. Y. Results from the MRI supplied by Saba ES et al. can be evaluated by looking for signs of brain structural disruption.

This research was based on some of the most recent studies, which were collected from scientific publications. by contrasting several variables that might be used in health care, particularly in the neurosurgical department. This study can further our understanding of the connection between mild traumatic brain injury and cognitive impairment. In future research, cognitive assessments can be carried out based on validated factors, and there is also no difference in the assessment of cognitive factors in some literature. Cognitive assessment can be done using more straightforward tools to track cognitive impairment caused by minor head injuries. The limitation of this study is that no results were shown based on the incidence of cognitive disorders. With all its limitations, this systematic literature review found that concussion can cause cognitive impairment in the long term.

5. Conclusion

Traumatic brain injury is one of the most common occurrences. According to GCS, it is classifiable. The most common incidences that result in brain damage are automobile accidents. Concussions are among the most frequent but also one of the most challenging to recognize. Just the structures in the brain are affected by minor injuries, which have no outward signs. The brain's White Matter is the area that a concussion can impact. Systems in the brain can be impacted by damage to the white matter. Microglia, a component of the cell that supports nerve cells, is another component that can sustain harm. A minimum of a year must pass after the follow-up. Cognitive level reduction is one of the outcomes of concussion. According to some research, there are a variety of indicators in a cognitive evaluation. It must use extreme caution since a person's quality of life might be negatively impacted by a decline in cognitive ability. This study also explains the significance of the brain for recovery following a collision.

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